

考生注意事項：所有考題務必在答案卷上作答。凡在問題卷上作答者無效。

一、選擇題(單選，每題二分，答案錯倒扣0.5分)

1. Which of the following aromatic amino acids has the strongest absorption of UV light at 280 nm when they are present in equimolar concentrations?
 - A. Tyrosine
 - B. Tryptophan
 - C. Phenylalanine
 - D. Histidine
 - E. Lysine
2. If a mixture of aspartate and glycine at pH 3.0 is poured through a cation-exchange column and eluted with more buffer (at pH 3.0), which of the following will happen?
 - A. Aspartate will elute first because it will have less net positive charge than glycine at pH 3.0.
 - B. Aspartate will elute second because it will have more net positive charge than glycine at pH 3.0.
 - C. Aspartate will elute first because it will have more net positive charge than glycine at pH 3.0.
 - D. Aspartate and glycine will elute together because they have identical pK_a s.
 - E. None of the above.
3. The peptide leucylvalylvalylalanylglutamyllysine has
 - A. no free amino group.
 - B. three free carboxyl groups.
 - C. five peptide bonds.
 - D. six peptide bonds.
 - E. none of the above.
4. The tripeptide Tyr-Lys-Met is first reacted with 1-fluoro-2,4-dinitrobenzene (FDNB) and then hydrolyzed in acid. The resulting solution will contain:
 - A. All three α -amino acids, each labeled by FDNB.
 - B. All three α -amino acids, but tyrosine and lysine will be labeled by FDNB.
 - C. All three α -amino acids, but only tyrosine will be labeled by FDNB.
 - D. One α -amino acid labeled by FDNB and an unlabeled dipeptide.
 - E. None of the above.

5. Which of the following protein extracts has the highest specific activity?

	Total protein (mg)	Activity (IU)
A	200	10,000
B	400	10,000
C	500	15,000
D	600	15,000
E	800	20,000

6. Incubation of an octapeptide with dansyl chloride gave a dansyl derivative of valine. When the native peptide was digested with trypsin, two tripeptides and a dipeptide were recovered. Incubation of the native peptide with cyanogen bromide (CNBr) gave two tetrapeptides. The likely sequence of the peptide is

- A. Val-Lys-His-Met-Ser-Arg-Ala-Leu.
- B. Ala-His-Lys-Met-Ser-Arg-Ala-Leu.
- C. Val-His-Met-Lys-Ser-Met-Ala-Leu.
- D. Val-His-Lys-Met-Ser-Arg-Ala-Leu.
- E. Ala-His-Lys-Met-Ser-Arg-Ala-Leu.

7. Which of the following statements about protein structure is INCORRECT?

- A. The primary structure refers to the sequence of amino acids in a protein.
- B. The α -helix is one of the secondary structure.
- C. The tertiary structure is produced by the interaction of side chains of the amino acids and is not dependent upon the sequence of amino acids in the protein.
- D. The quaternary structure requires the presence of more than one polypeptide chain.
- E. None of the above.

8. Three proteins (X, Y and Z) in a mixture are to be separated and purified. The best method to fractionate these proteins with retention of their activity would be

Protein	Molecular weight	isoelectric point
X	84,000	5.0
Y	43,000	4.9
Z	45,000	7.5

- A. ammonium sulfate precipitation followed by gel filtration.

- B. gel filtration followed by peptide mapping.
C. gel filtration followed by ion-exchange chromatography at pH 6.0.
D. gel filtration followed by ion-exchange chromatography at pH 2.0.
E. gel filtration followed by SDS-polyacrylamide gel electrophoresis.
9. Which of the following reagents is used to determine the amino acid sequence of a peptide
- A. Urea
B. CNBr
C. Mercaptoethanol
D. Ninhydrin
E. Phenylisothiocyanate
10. Which of the following statements about an α helix is INCORRECT ?
- A. An α helix would be destabilized by the presence of two Lys+ residues near the amino terminus of the α helix.
B. Thr and Leu residues occur next to each other in a protein tend to disrupt an α helix.
C. Proline residue is commonly found in an α helix.
D. The R groups on the amino acid residues are found on the outside of the α helix spiral.
E. None of the above.
11. Amino acid residues commonly found at the end of a β turn are:
- A. Ser and Pro.
B. Val and Gly.
C. Ile and Met.
D. Pro and Gly.
E. hydrophobic.
12. The O_2 -saturation curve of hemoglobin
- A. is simple hyperbolic.
B. is sigmoid.
C. shows negative cooperativity.
D. is the same as that of myoglobin.
E. none of the above.
13. Which of the following statements about enzyme is INCORRECT ?
- A. Enzymes can increase the equilibrium constant of a reaction, thus favoring

- product formation.
- B. Enzymes can lower the activation energy for the conversion of substrate to product.
 - C. Enzymes can increase the rate at which substrate is converted into product.
 - D. Most enzymes are proteins.
 - E. None of the above.
14. Carbonic anhydrase requires Zn^{++} to accomplish its catalytic activity. In the absence of zinc, Carbonic anhydrase would be referred to as a(n)
- A. coenzyme.
 - B. cofactor.
 - C. prosthetic group.
 - D. holoenzyme.
 - E. apoenzyme.
15. The Michaelis-Menten constant K_m
- A. equals the $[S]$ at which $V = V_{max}$.
 - B. equals the $[S]$ at which $V = 1/2V_{max}$.
 - C. equals the $1/2[S]$ at which $V = V_{max}$.
 - D. equals the $1/2[S]$ at which $V = 1/2V_{max}$.
 - E. can not be determined from the Lineweaver-Burk plot.
16. The following set of data for an enzyme is known to follow Michaelis-Menten kinetics.

Substrate concentration (mM)	Initial velocity ($\mu\text{mol}/\text{min}$)
1	267
2	400
4	534
6	600
200	798
800	799

The V_{max} for the enzyme is

- A. 267 $\mu\text{mol}/\text{min}$
- B. 400 $\mu\text{mol}/\text{min}$
- C. 534 $\mu\text{mol}/\text{min}$
- D. 600 $\mu\text{mol}/\text{min}$
- E. 800 $\mu\text{mol}/\text{min}$

17. The K_m for the enzyme in question 16 is
- A. 1 mM.
 - B. 2 mM.
 - C. 4 mM.
 - D. 6 mM.
 - E. 200 mM.
18. The K_m of an enzyme-catalyzed reaction that follows Michaelis-Menten kinetics would be altered by the presence of
- A. a competitive inhibitor.
 - B. a noncompetitive inhibitor.
 - C. both A and B.
 - D. excess substrate.
 - E. none of the above.
19. Which of the following statements about allosteric enzymes is **INCORRECT**?
- A. Allosteric enzymes are generally composed of several subunits.
 - B. Allosteric enzymes usually follow Michaelis-Menten kinetics.
 - C. An effector may either activate or inhibit an allosteric enzyme.
 - D. The binding of an effector may change the conformation of an allosteric enzyme.
 - E. none of the above.
20. The activation of trypsinogen to trypsin involves
- A. a tetramer formation of two inactive trypsinogen dimers.
 - B. the binding of cAMP to trypsinogen.
 - C. the peptide bond cleavage of trypsinogen molecule.
 - D. the phosphorylation of trypsinogen.
 - E. the binding of Ca^{++} to trypsinogen.
21. Which of the following compounds is **NOT** a proteoglycan?
- A. hyaluronate
 - B. heparin
 - C. chondroitin sulfate
 - D. keratan sulfate
 - E. amylose
22. Which one of the following is an anomeric pair?
- A. α -D-glucose and α -L-glucose.

- B. α -D-glucose and β -D-glucose.
C. α -D-glucose and β -L-glucose.
D. D-glucose and L-fructose.
E. D-glucose and D-mannose.
23. Which of the following amino acid residues are involved in the linkages between oligosaccharides and glycoproteins?
- A. Ser, Glu, Thr
B. Ala, Thr, Asn
C. Ser, Thr, Asp
D. Ser, Thr, Asn
E. Gly, Ser, Thr
24. A glycogen molecule
- A. is composed of β -D-glucose polymer.
B. is a heteropolysaccharide.
C. has only one reducing end.
D. has many reducing ends.
E. contains a branched amylose unit.
25. Which of the following monosaccharides has no chiral centers?
- A. Erythrulose
B. Glyceraldehyde
C. Dihydroxyacetone
D. Fructose
E. Glucose
26. The major carrier of chemical energy in all cells is:
- A. adenine.
B. adenosine.
C. adenosine triphosphate.
D. acetyl chloride.
E. None of the above.
27. All of the following subcellular organelles can be isolated essentially intact EXCEPT:
- A. endoplasmic reticulum.
B. chloroplasts.
C. peroxisomes.
D. mitochondria.

- E. nuclei.
28. A compound is known to have a free amino group with a pKa of 8.8, and one other ionizable group with a pKa between 5 and 7. To 100 mL of a 0.2 M solution of this compound at pH 8.2 was added 40 mL of a solution of 0.2 M hydrochloric acid. The pH changed to 6.2. The pKa of the second ionizable group is:
- A. 5.42.
 - B. 5.6.
 - C. 6.02.
 - D. 6.2.
 - E. impossible to determine from this information.
29. Which of the following statements about symbiotic association is **INCORRECT** ?
- A. A symbiotic association is the intimate physical association of two different organisms that is beneficial to both organisms.
 - B. It is believed that primitive eukaryotic cells, which were incapable of photosynthesis or aerobic metabolism, formed symbiotic associations with photosynthetic and/or aerobic bacteria.
 - C. The aerobic bacteria evolved into the mitochondria found in modern eukaryotic cells.
 - D. The photosynthetic bacteria evolved into the chloroplasts found in plant cells.
 - E. None of the above.
30. The endoplasmic reticulum (ER) and the Golgi complex are very important in the production and transport of proteins. Which of the following statements about the production and transport of proteins is **INCORRECT** ?
- A. Proteins that are to be transported from a cell or inserted into the plasma membrane are synthesized on ribosomes attached to a portion of the ER known as the rough ER.
 - B. After the proteins are synthesized, they pass through the ER membrane into the ER lumen.
 - C. As the proteins pass through the Golgi complex, they are modified by the addition of sulphate, carbohydrate, or lipid moieties. Some of these modifications serve as signals or "addresser" that determine the final location of these proteins.
 - D. Proteins to be transported from the cell are packaged in secretory vesicles and exit the cell by exocytosis.
 - E. None of the above.

31. Which of the following statements about membrane lipids is TRUE ?
- A. They are more soluble in water than in chloroform.
 - B. Glycerophospholipids contain fatty acids linked to glycerol through amide bonds.
 - C. Glycerophospholipids are found only in the membranes of plant cells.
 - D. Some sphingolipids include oligosaccharides in their structure.
 - E. Lecithin, which is used as an emulsifier in margarine and chocolate, is a sphingolipid.
32. Which of the following is a fat-soluble vitamin and derived from cholesterol ?
- A. Vitamin A.
 - B. Vitamin C.
 - C. Vitamin D.
 - D. Vitamin E.
 - E. Vitamin K.
33. Tay-Sachs disease is the result of a genetic defect in the metabolism of
- A. the lack of a phospholipid-synthesizing enzyme.
 - B. a deficiency of ganglioside due to the lack of ganglioside-synthesizing enzymes.
 - C. an accumulation of ganglioside due to an overactive ganglioside-synthesizing enzyme system.
 - D. an accumulation of ganglioside due to the lack of ganglioside-degrading enzyme.
 - E. the lack of vitamin D-synthesizing enzyme.
34. Which of the following statements about sterols is INCORRECT ?
- A. Cholesterol is a sterol that is commonly found in mammals.
 - B. They have a structure that includes four fused rings.
 - C. They are commonly found in bacterial membranes.
 - D. They are precursors of steroid hormones.
 - E. They are more common in plasma membranes than in intracellular membranes.
35. The plasma membrane of *E. coli* is about 75% lipid and 25% protein by weight. Assume that the average molecular weight of protein is 50,000 and that of lipid is 750. How many molecules of membrane lipid are there for each molecule of protein ?
- A. 50,000
 - B. 10,000

- C. 200
D. 50
E. 1
36. Which of the following statement about lipid bilayer is a general feature in all biological membranes ?
- A. Individual lipid molecules in one face of the bilayer readily diffuse (flip-flop) to the other monolayer.
 - B. Individual lipid molecules are not free to diffuse laterally in the surface of the bilayer.
 - C. Polar, but uncharged, compounds readily diffuse across the bilayer.
 - D. The bilayer is stabilized by covalent bonds between neighbouring phospholipid molecules.
 - E. Lateral diffusion of individual lipid molecules with the plane of each monolayer is a common type of motion.
37. An integral membrane protein will commonly be solubilized by extraction with:
- A. a buffer of alkaline or acid pH.
 - B. a solution containing detergent.
 - C. a solution of high ionic strength.
 - D. a chelating agent that removes divalent cations.
 - E. hot water
38. Which of the following lipoprotein density categories consists mainly of cholesterol ?
- A. chylomicrons
 - B. VLDL
 - C. LDL
 - D. HDL
 - E. None of the above
39. A typical plasma membrane would be most likely to have which of the following weight compositions ?
- A. 35% of lipid, 45% of protein, 5% of carbohydrate and 10% of RNA.
 - B. 35% of lipid, 55% of protein, 5% of carbohydrate and 0% of RNA.
 - C. 20% of lipid, 75% of protein, 0% of carbohydrate and 0% of RNA.
 - D. 60% of lipid, 30% of protein, 0% of carbohydrate and 5% of RNA.
 - E. 35% of lipid, 40% of protein, 20% of carbohydrate and 0% of RNA.

40. Which of the following statements about ionophore is CORRECT ?
- A. An ionophore may diffuse back and forth across a membrane.
 - B. An ionophore may form a channel across a membrane through which an ion may diffuse.
 - C. An ionophore may catalyze electrogenic mediated transport of an ion.
 - D. All of the above.
 - E. None of the above.
41. How many nitrogen atom is in adenosine?
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5
42. In a double stranded DNA, which of the following is true? [X] indicates the number of X residues.
- A. [A] = [C]
 - B. [G] = [T]
 - C. [A] + [T] = [G] + [C]
 - D. [A] + [C] = [G] + [T]
 - E. None of the above
43. Suppose that two turns of B-DNA in a circular DNA molecule with $L = 100$ and $W = -4$ become two turns of Z-DNA. What are the values of L , T , and W following the transition? L = linking number, T = twist number, and W = writhe number.
- A. $T = 100$
 - B. $W = -6$
 - C. $L = 102$
 - D. $T = 102$
 - E. $W = -4$
44. Which of the following statements is INCORRECT ?
- A. DNA exists in a nucleoprotein complex called chromatin in eucaryotic cell.
 - B. The proteins of chromatin are composed only of histones.
 - C. Five distinct histones are known: H1, H2A, H2B, H3, and H4.
 - D. The nucleosome is composed of DNA and histones.
 - E. Nuclear matrix, a scaffold of proteins, provide a structural framework within the nucleus.

45. Which of the following DNA sequences is most likely to be recognized by type II restriction enzyme?
- A. 5'-GGCAAATA-3'
 - B. 5'-GGGGTTTT-3'
 - C. 5'-AAAAAAAA-3'
 - D. 5'-GGGGCCCC-3'
 - E. 5'-GACTGACT-3'
46. Which of the following statements is INCORRECT ?
- A. T4 DNA ligase can ligate blunt-end DNA.
 - B. Bacteriophage λ is a cloning vector.
 - C. Cosmid can be used to clone 7-20 kb DNA.
 - D. Southern blotting method is used to analyze genomic DNA.
 - E. None of the above.
47. Assume ribose-5-P is available, starting from glutamate, aspartate, glycine, CO_2 , and N^{10} -formyl-THF, how many ATP equivalents are expended in the synthesis of ATP?
- A. 1
 - B. 3
 - C. 5
 - D. 7
 - E. 9
48. Which of the following statements correctly describes the pathway by which purine nucleotides are synthesized?
- A. The first enzyme in the path is aspartate transcarbamoylase.
 - B. The purine rings are first synthesized, then condensed with ribose phosphate .
 - C. The pathway occurs only in plants and bacteria, not in animals.
 - D. Purine deoxynucleotides are made by the same path as ribonucleotides, followed by reduction of the ribose moiety.
 - E. The nitrogen in the purine base that is bonded to ribose in the nucleotide is derived originally from glycine.

49. Regulation of IMP synthesis is NOT regulated

- A. at ribose-5-phosphate pyrophosphokinase.
- B. at glutamine / 5-phosphoribosyl- α -pyrophosphate amidotransferase
- C. at adenylosuccinate lyase
- D. by GDP
- E. by AMP

50. Which of the following is NOT used in biosynthesis of pyrimidine?

- A. ATP
- B. carbamoyl phosphate
- C. glutamine
- D. aspartate
- E. None of the above